Mycological Bulletin

No. 79

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Columbus, Ohio, July, 1907.

A PHALLUS NUMBER.

Professor W. H. Long of the State Normal School, Denton, Texas, has published in a recent Number of the Journal of Mycology, an extended account of the Phalloideae or Stink-horns of Texas, illustrated by several half-tone illustrations of the species. We devote this number of the Bulletin to this subject, reproducing Professor Long's plates, and a fair portion of the interesting text of the article.

THE PHALLOIDEAE OF TEXAS.

BY WILLIAM H. LONG.

The fall of 1902 was unusually wet for this State and cold weather was late in coming, as our first good frost did not occur until Nov. 22. Such climatic conditions brought forth a wealth of fungi; the Basidiomycetes and Gastromycetes being especially abundant. It was the good fortune of the writer to collect and have photographed five species of that unique and interesting group of Gastromycetes—the *Phalloids.*

In an old sandy field, that had not been ploughed for seven or eight months, four species were found, viz: *Mutinus caninus, Phallus rubicundus, Phallus impudicus* var. *imperialis,* and *Simblum sphaerocephalum.* This field was on the north slope of a hill that was originally covered with post oak (*Quercus minor*) and black jack (*Q. nigra*), but the trees had been cut off for some years and the old stumps were in various stages of decay.

At the base and in the immediate vicinity of these rotting stumps the plants mentioned were usually found. On the margin of this field in the grassy unbroken sod *Simblum texense* was collected. This field was planted in wheat in the fall of 1901 and was used as a pasture for cattle during 1902.

Nearly all of the photographs secured were taken by a local photographer on cloudy days and in some instances when the rain was falling, as this group will not admit of delay if photographs of the freshly expanded plants are desired. Some here reproduced therefore do not show details as well as could be desired.

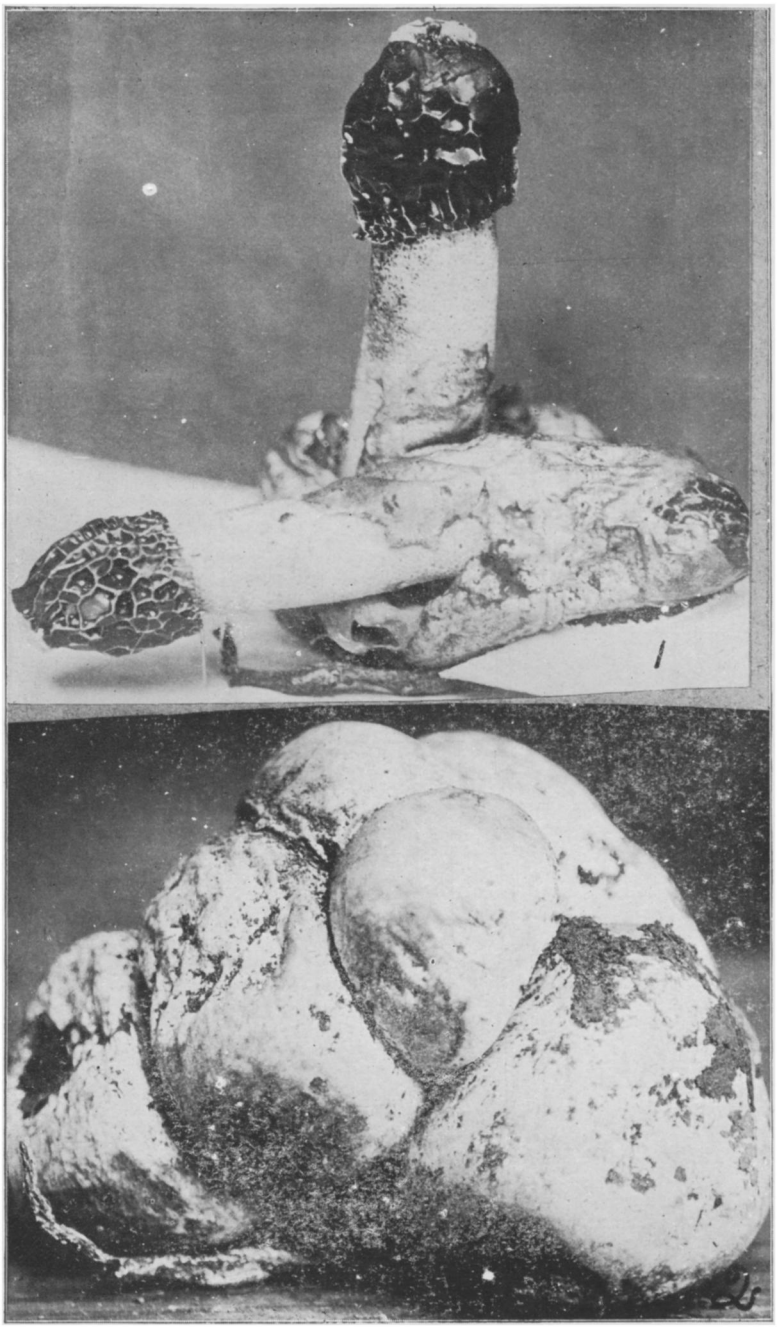

Fig. 253.—PHAL'-LUS IM-PU'-DI-CUS var. IM PE-RI-A'-LIS. Plants (1) grown from eggs (2). Phot. W. H. Long, Texas.

The abundance of material at hand of some species made it possible for the writer to determine the relative values of the various characters of a given species.

The following characters were found to be constant for any given species, viz: Color of stipe, pileus and eggs, surface markings of cap, structure of stipe as to number, shape and openings of the chambers; variable characters were: Shape of both stipe and pileus within narrow limits, presence or absence of a veil, size of stipe and cap and shape and size or eggs.

Take the cap of *Phallus impudicus* for instance. It was invariably white and strongly reticulate, but its size and shape was very variable, in some plants being very unsymmetrical but more or less conic to campanulate but even in specimens only two inches tall the surface had the characteristic crests and ridges. On some specimens no veil could be detected, while on others there was a strongly developed veil, but this point will be discussed more in detail later in this article.

In *Simblum texense* the variation in shape and size of pileus and stipe was very marked; the stipe being cylindrical, fusiform, clavate, attenuate downward or upward, terete or angular, while its color and structure was constant; the pileus likewise was very variable as to shape and size, some specimens being deeply constricted at juncture of pileus and stipe, while in others there was no constriction. Some had the Simblum characters well defined, while others looked more like a Lysurus with short arms than a Simblum. Indeed it is difficult to determine the genus of this plant from the ordinary field specimens.

The first specimens found of *Phallus impudicus* var. *imperialis*, consisted of two separate bunches of eggs. One bunch of four eggs from a common rhizomorph, the other of eight plants, also from a common root. All of the eggs in the first group were infested by the larvae of some unknown fly (*Muscidae*), also several eggs in the second group. This is the first instance to the writer's knowledge of an insect attacking the eggs of any of the Phalloids, although it is well known that various species of flies (*Muscidae*) eagerly suck the syrupy mass of spores as the gleba deliquesces by this means the wider distribution of the spores is accomplished; while the passage through the digestive tube of the fly may aid in the germination of the spores. A miscroscopic examination of the excreta from the flies that are feeding on the deliquescent gleba shows it to be composed largely of spores, apparently unharmed. This syrupy mass acts on them like a dose of salts, producing a kind of diarrhoea.

A third insect was found feeding on all the Phalloids except *Simblum texense*—a species of dung beetle or "tumble bug" (*Geotrupes opacus* Hald.). The beetles first attack the stipe. One was found on the stipe of *Phallus impudicus* eating a circle around it, thereby cutting it down; its mate was at the base of the plant, busily engaged in digging a hole in the ground; when the stipe fell both beetles attacked it.

This species of dung beetle apparently makes no balls but digs holes under the mass of dung on which they may be feeding. It is interesting to note that the same process was followed while feeding on the Phalloids. They eat the stipe down to the ground but do not attack the volva; the entire stipe and cap was often devoured so that nothing was left but the stump of the stipe in the volva and the numerous holes that the beetles had dug near by. I found specimens of *Phallus rubicundus, Phallus impudicus, Mutinus caninus,* and *Simblum sphaerocephalum,* all attacked and eaten by this beetle, but strange to say, not one plant of the many specimens found of *Simblum texense* was eaten—probably because this plant has not the foetid odour so characteristic of this group.

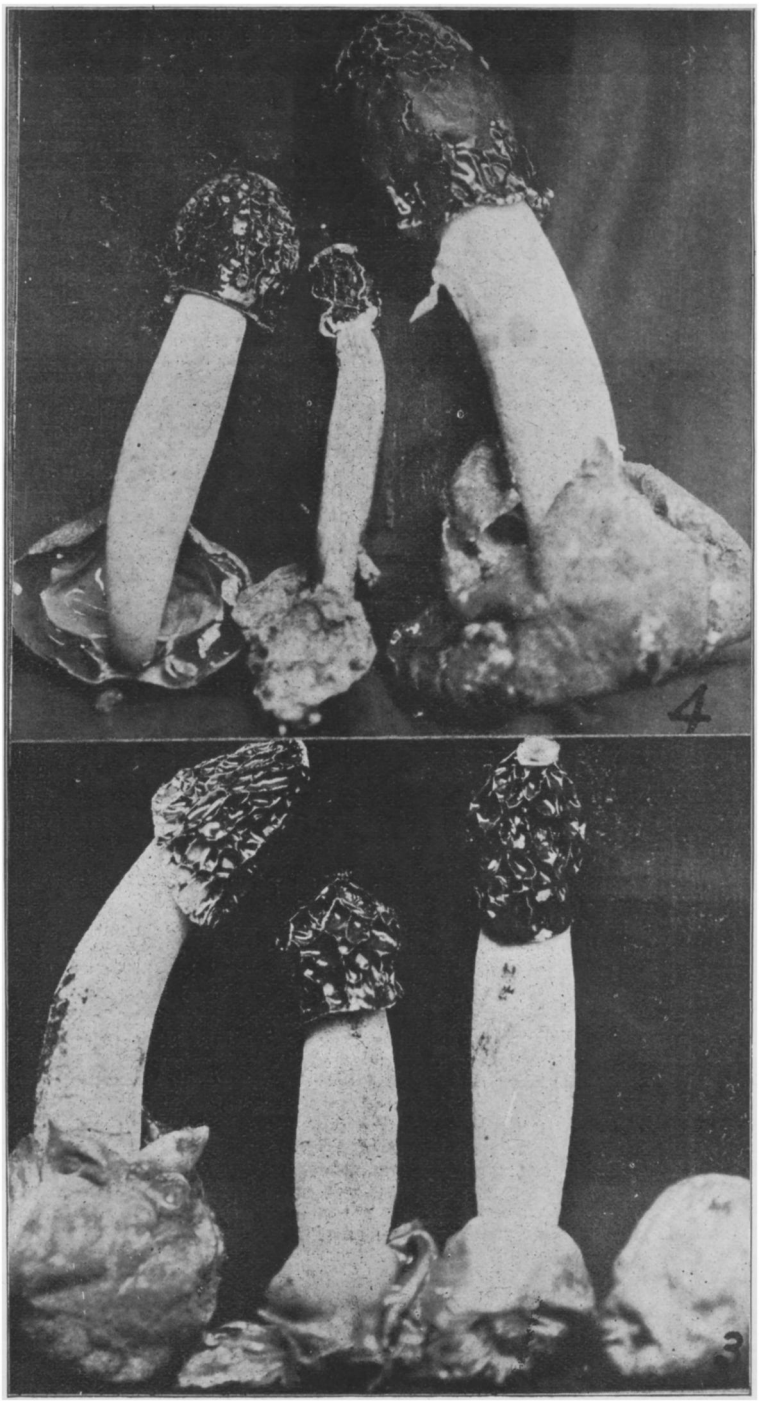

Fig. 254.—PHAL'-LAS IM-PU'-DI-CUS var. IM-PE-RI-A'-LIS. Typical plants (3) and plants showing veils (4). Phot. W. H. Long, Texas.

At one time I had about one hundred and fifty to two hundred eggs of the various species of Phalloids in my "incubator" and during the course of their expansion it was noticed that cold had a marked effect on the elongation of the stipe—in all cases checking it; and when the thermometer was below or near freezing point stopping all elongation. This was so marked that I had to resort to artificial heat to get some of my eggs to expand. This indicates that the elongation of the stipe or receptaculum is a growth process as advanced by Errera and Burt. The large number of eggs of the various species of Phalloids that I collected, together with the cool weather during November, forced me to devise some means whereby I could with little trouble hatch them, as there was no hot house convenient. At first, I used with fairly good success the following plan. I took a pine box one and a half to two feet deep and covered the bottom with clean white sand to the depth of eight to ten inches. The eggs were then washed and wrapped with tissue paper, leaving only the upper part free; they were then put into holes in the sand with only the upper and free surface exposed, the sand being previously thoroughly wetted. The box was then covered with glass and placed near a wood stove and every eight or twelve hours—usually once at night and again early next morning, a gallon of water, hot as the hand could stand, was poured over the eggs and on the sand; by this means the sand and the air in the interior of the box was kept warm and moist. Eggs of *Phallus impudicus, Phallus rubicundus, Mutinus caninus,* and *Simblum texense* were thus hatched. The writer found great trouble in getting the eggs of *Simblum texense* to hatch in a moist chamber on account of a species of white mould attacking and destroying them. In warm weather all that is necessary is to keep the sand wet and the box in the sun light with the glass over it. Some sixty to a hundred eggs of *Simblum texense* were expanded by this means.

A careful study of the specimens of *Phallus impudicus* and *Phallus rubicundus,* as they were expanding, seems to indicate that *Dictyophora* is not a good genus. Many of the plants, especially of *Phallus impudicus,* showed veils of varying degrees of permanency—from a mere film to one of appreciable thickness, and in every respect, as to texture, size, thickness, and position comparable to the so-called veil of *Dictyophora ravenelii.*

This veil in *Phallus impudicus* and *Phallus rubicundus* lies in the unexpanded plant as a zone of tissue next to the stipe. As the stipe elongates this membrane usually ruptures at edge of cap or beneath it, then as elongation continues bands and shreds of it may be left on the stipe. It will be found in one of three places and sometimes in all of them; first, as a veil hanging from top of stipe beneath the cap; second, as a distinct membrane in bands and patches on the stipe; third, as an enveloping sac-like membrane around the base of the stipe inside of the volva; here it seems to be a prolongation of the inner cup-like membrane of the volva that fits closely to the base of the stipe inside of the volva; this membrane like that of *Phallus ravenelii* is not composed of pseudoparenchyma, but in every other respect it is a true veil.

That those species with a persistent, well developed, meshed pseudoparenchymatous veil, like *Phallus duplicatus,* deserve special rank seems not proven—for intergrading forms of more or less persistent and well defined veils are present in many species of Phallus; furthermore, the presence of a well defined veil in *Phallus impudicus,* the original type of the Phallus genus, would make this genus have as one of its characters a veil and the genus *Dictyophora* would now be identical in all respects to Phallus and would therefore be reduced to synonomy.

The veils in my specimens were especially pronounced in plants that were slow in opening both in *Phallus impudicus* and *Phallus rubicundus.*

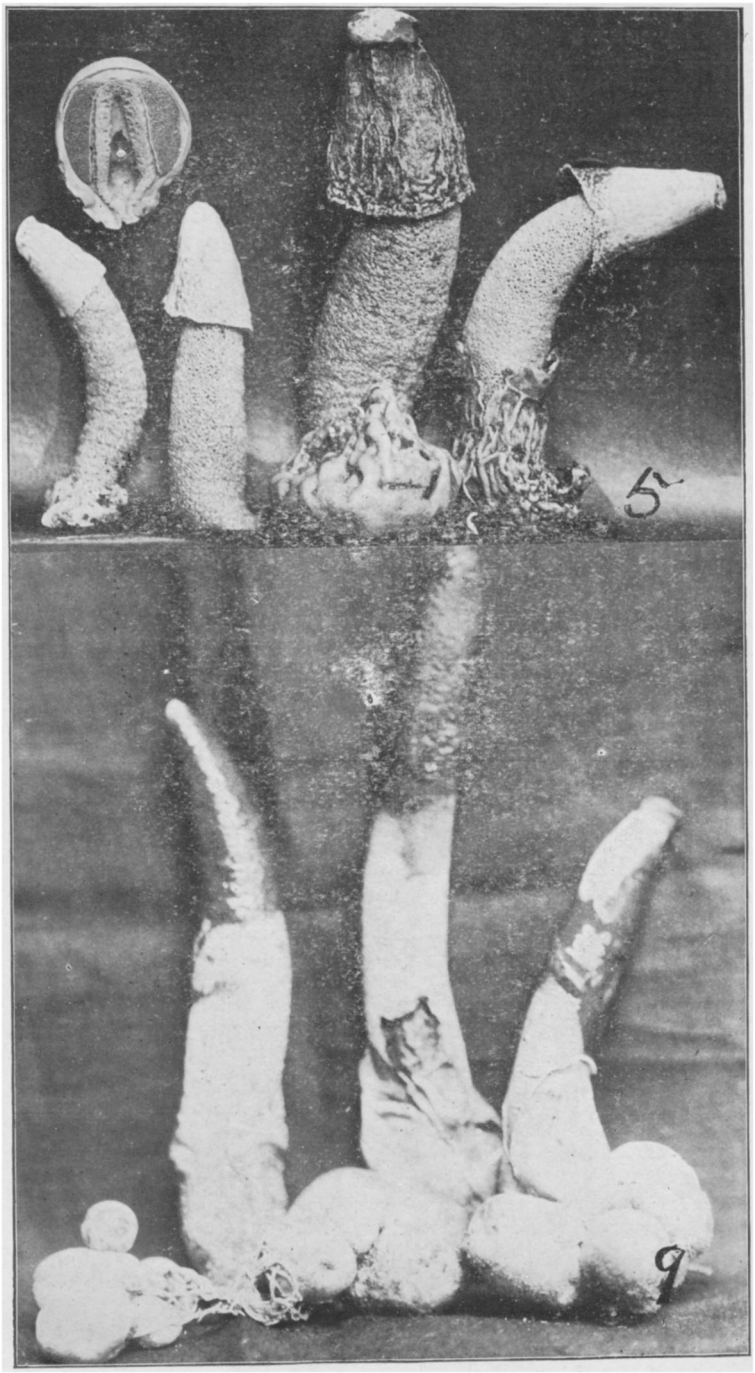

Fig. 255.—PHAL'-LUS RU-BI-CUN'-DUS (2) and MU-TI'-NUS CA-NI'-NUS (9). Phot. W. H. Long, Texas.

Those eggs that had been some three or four weeks in the "incubator" usually had thicker and more permanent veils than those that opened two or three days after collecting, while those found in the open fields had veils well developed if eggs opened during rainy weather. Also those plants that opened after cold weather came had veils. Specimens of *Phallus rubicurdus* collected at Austin, Texas, during April, May and June, have no sign of a veil of any kind, not even the alcoholic material (of which I have some ten to fifteen specimens), shows any trace of a veil. Considering these facts, it would seem that this layer of tissue that sometimes tears lose and forms a veil and sometimes does not, acts as an organ of nutrition in which is stored, or through which passes, food to be used by the stipe and cap; if this be the case, then in warm, damp weather the maturing stipe and cap would use most of this in their development, so that at elongation of plant no real veil would appear. In other words, it would cling to the under side of the cap and to the inner surface of the volva; but if the amount of water during the growing season was in excess of the quantity usually present, then this tissue with others would be more strongly developed than normally and, therefore, would be more likely to appear as a veil at maturity of the plant; or if from any cause, as cold, removal from earth, etc., the later development of plant should be checked, then this tissue would appear as a veil; this is only an hypothesis, the proof of which remains yet to be worked out. At any rate the fact remains that in these two species the veil may or may not be present, and when present may be a mere thin membrane or one of appreciable thickness and permanency that will and does persist when the plants are dried or when kept in fluids. The presence of a veil on *Phallus impudicus* has been noted and discussed before by Van Bambeke, also by Ed. Fischer.

Phallus impudicus, L. var. *imperialis*, *Schw.* This was our most abundant Phallus in the Fall of 1902. It was first collected October the twentieth and specimens were found from then till the middle of January, 1903. On October the twentieth the two large bunches of eggs were found in a low, damp place, rich in vegetable debris, one bunch was so badly eaten by the fly larvæ that none of the eggs hatched, but two of the eggs of the larger bunch hatched. This bunch is seen in photograph No. 1, then No. 2 shows it with two eggs hatched, and some had been removed from bunch being destroyed by the larvæ.

EXPLANATION OF FIGURES 253-256.

Fig. 253.—Group of 8 eggs of *Phallus impudicus* var. *imperialis* from a common rhizomorph (2); and expanded plants from group of same.

Fig. 254.—*Phallus impudicus* var. *imperialis*, typical plants (3); also plants showing veils; the middle plant a dried specimen with veils still pendent below pileus. (4).

Fig. 255.—*Phallus rubicundus*, showing rugosity of pileus; all specimens from Austin, Texas, and alcoholic material (5); *Mutinus caninus* (9).

Fig 256.—*Phallus rubicundus*, non perforate plant (6); plants showing shreds of veil on stipes and one plant perforate (7); plants showing veil at base of pileus and remnant of volva at apex (8).

(*Excerpt from Journal of Mycology.*)

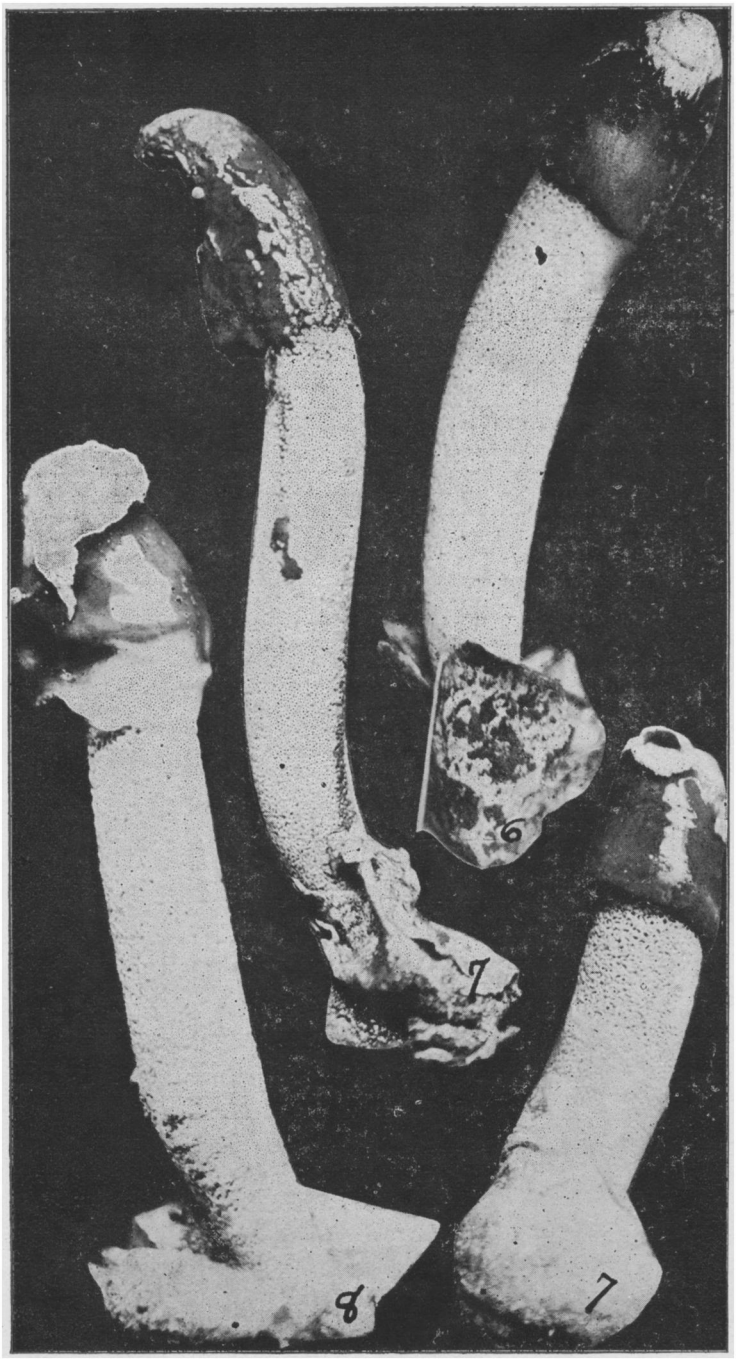

Fig. 256.—Paeli'lus ru-bi-cun'-dus. W. H. Long, Texas.